Program Improvement Report

Bachelor of Science

in

Computer Information Systems

2014-2015

Compiled by

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1. INTRODUCTION

To have computing programs that meet the needs of their many constituencies, continuous program evaluation and improvement is necessary. The Computer Science (CSCI) department at CSU, Chico has developed a program improvement process that is designed to achieve departmental program objectives that are based on the mission statements for the University, College, and Department. The above-mentioned constituencies include the faculty, employers, alumni, and students. Each group provides detailed information at some point in this process. The department's mission has been designed to reflect the mission of the College of Engineering, Computer Science and Construction Management and of the University.

The mission and objectives of the Computer Science department’s Bachelor of Science in Computer Information Systems (CSCI) program is reviewed at least once every six years by representatives of all constituencies. Embedded assessment, senior exit surveys, and industry advisory board semi-annual meetings are primary sources of input. The faculty, as a whole, evaluates the inputs to decide if any changes in the objectives are warranted. If changes are made, the assessment plans are revised to reflect the changes. The CSCI department is responsible for verifying that its graduates satisfy the educational objectives of its programs. The CSCI department’s assessment plans for both of its programs are posted on the department website at http://csci.ecst.csuchico.edu/assessment.

2. Program Educational Objectives

The following sections describe the Mission Statements of:

- the California State University, Chico;
- the College of Engineering, Computer Science and Construction Management; and
- the Computer Science Department and the Department’s program in Computer Information Systems.

These sections also discuss the Program Educational Objectives (PEOs) of the CSCI program and their relationship to the Mission Statements.

2.1. The CSU, Chico

2.1.1. Mission, Vision and Goals Statements

1. **Mission:** California State University, Chico is a comprehensive university principally serving Northern California, our state and nation through excellence in instruction, research, creative activity, and public service. The University is committed to assist students in their search for knowledge and understanding and to prepare them with the
attitudes, skills, and habits of lifelong learning in order to assume responsibility in a
democratic community and to be useful members of a global society.

The division of Academic Affairs advances the mission of the University to serve
Northern California, the state, the nation and the global community through excellence
in learning, scholarship and creativity, and public engagement.

Vision: California State University, Chico sees its distinctive residential context as an
opportunity to create an active, diverse, healthy, caring, innovative, and green learning
and working environment. We aim to create a vital and collaborative living and learning
experience for students, who will appreciate and embrace the local, regional, and global
communities of which we are all a part. We have a well-respected and dedicated faculty,
a superior staff, and committed leadership together with cutting-edge learning and
information resources. All of these assets are placed within a beautiful and engaging
physical environment. We are a place devoted to the academy's most fundamental,
tenets: reason, respect, civility, and community.

The division of Academic Affairs is a vibrant learning community of engaged students
and well-respected, dedicated faculty, staff and administrators that is purposeful,
inclusive, collegial, respectful and celebrative. We are known for excellence in
learning, especially for our role of facilitating student learning and student success. We
acknowledge our public purpose by developing, applying and exchanging knowledge
and expertise for the mutual benefit of our community and our region. We bring about
personal, organizational, national and global sustainable development through efforts
that are intellectually honest, environmentally friendly, economically sound, politically
viable, and socially just. By compelling example and through effective dialogue, we
improve the human condition in the twenty-first century.

2.1.2. University Strategic Goals (USGs)

1. Enhance student learning–both inside and outside the classroom.
   - Recruit, enroll, retain and graduate a diverse, high-quality student
     population.
   - Offer excellent and distinctive programs.
   - Deliver active, collaborative and transformative pedagogies.
   - Support student participation in regional, national and international learning
     opportunities.
   - Ensure access to the most effective information and learning resources.
   - Provide superior student support systems.
   - Demonstrate educational effectiveness.

2. Nurture excellence in faculty and staff.
   - Recruit, develop, and retain a diverse, excellent faculty and staff.
3. **Educate for a sustainable global society.**
   - Deliver curricular and extra-curricular programs for sustainability.
   - Promote scholarly and creative activities in sustainability.
   - Provide regional leadership for sustainable development practices.
   - Assist the University to serve as a model sustainable campus.

4. **Serve the North State and beyond.**
   - Address diverse educational needs.
   - Stimulate sustainable economic development.
   - Support a rich cultural and artistic environment.
   - Collaborate through mutually beneficial public engagement initiatives.

5. **Strategically manage resources in support of mission, shared values and vision.**
   - Marshal resources to achieve mission, vision and goals.
   - Align all resources to achieve mission, vision and goals.
   - Foster a culture of evidence-based planning and decision making across all units.
   - Demonstrate organizational effectiveness.

2.1.3. **University Strategic Priorities (USP)**

1. Believing in the primacy of learning, we will continue to develop high-quality learning environments both inside and outside the classroom.

2. Believing in the importance of faculty and staff, and their role in student success, we will continue to invest in faculty and staff development.

3. Believing in the wise use of new technologies in learning and teaching, we will continue to provide the technology, the related training, and the support needed to create high quality learning environments both inside and outside of the classroom.

4. Believing in the value of service to others, we will continue to serve the educational, cultural, and economic needs of Northern California.

5. Believing that we are accountable to the people of the State of California, we will 1
3. Program Outcomes

Program outcomes are defined as “statements that describe what students are expected to know and be able to do by the time of graduation that enable them to meet the objectives.” The Program Outcomes for the Computer Information Systems program are listed below:

Our CINS graduates must demonstrate:

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline.

b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.

d. An ability to function effectively on teams to accomplish a common goal.

e. An understanding of professional, ethical, legal, security and social issues and responsibilities.

f. An ability to communicate effectively with a range of audiences.

g. An ability to analyze the local and global impact of computing on individuals, organizations, and society.

h. Recognition of the need for and an ability to engage in continuing professional development.

i. An ability to use current techniques, skills, and tools necessary for computing practice.

j. An understanding of and an ability to support the use, delivery, and management of information systems within an Information Systems environment. [IS]

These outcomes are posted on the department web site, at http://csci.ecst.csuchico.edu/assessment/b.s.-in-computer-information-systems/outcomes. They also appear in a number of departmental documents, including the Program Improvement Plans and the CINS Program Assessment Reports found on the department web site.

3.1. Relating Program Outcomes to Program Educational Objectives

Our program outcomes identify what our graduates are expected to know or be able to do upon graduation. These outcomes were updated from our previous Program Assessment Plan to reflect ABET changes to Computing Accreditation Criteria. Table 1, below, lists the program objectives and the specific CINS program outcomes that relate to each program objective.
Table 1: Program Objectives X Program Outcomes Matrix

<table>
<thead>
<tr>
<th>Program Objectives</th>
<th>CINS Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>A</td>
<td>X</td>
</tr>
<tr>
<td>B</td>
<td>X</td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

All of the program objectives are assessed by examining the attainment of outcomes that are related to them. Many of the outcomes are themselves measured by embedding them into the course, using direct tests for selected outcomes in the assessment of student performance and in the grading processes. These measures are augmented by indirect assessment of outcomes via exit surveys of graduating seniors, exam scores of graduation seniors on the Institute for Certification of Computing Professionals (ICCP) exam and inputs from the Industrial Advisory Board. Problems encountered in the assessment process may cause the objectives, and the outcomes associated with them, to be re-examined.

The direct assessment used in the outcomes related to objectives A, B, D and E (i.e., outcomes a, b, c, e, g, h and i) is generally well integrated into the curriculum of the courses(s) chosen for the assessment of each Program Outcome. Consider, for example, CSCI 301, which is a core course in CINS curriculum. This course is designed, in part, to address outcomes that relate specifically to objective D, which states that students will “understand the ethical and technical context of their professional obligations and contributions.” The outcomes are reflected in specific questions included in quizzes and tests for that purpose, and in other measures of classroom performance which are carefully chosen with this intent. Students who are successful in these measures are presumed to have achieved the outcomes targeted by the question sets. Similar rationales exist for every course in which embedded assessment of the outcomes that relate to these four objectives is
carried out. Indirect assessments of these objectives are done via periodic surveys of graduates, alumni and employers.

Objective C is directly assessed via specific outcomes in courses in which teamwork and/or communication is a major component. Assessment can take the form of determining each team-member’s effectiveness via anonymous reports, or by using a rubric to assess the student’s speaking and/or writing skills. Copies of some of these rubrics may be found in the portion of the department web site devoted to assessment.

Objective F is assessed by the simple expedient of querying graduating students about their employment prospects and by tracking the advancement of their careers. Surveying students’ employment prospects also occurs in the capstone course entitled “Directed Programming Experience,” which serves multiple purposes, including the determination of whether students recognize the necessity for a lifetime of learning to stay current in the discipline. The campus Placement Center maintains records of placements. Unfortunately, the accuracy of these records is impacted by the fact that they are based entirely on hiring that happens within the context of the Center’s interview and placement process: most students either fail to provide follow-up information or obtain positions outside of the formal campus interview process and fail to update the Placement Center’s records. Additional input on this topic comes from the same surveys used to indirectly assess Outcomes associated with Objectives A, B, D and E. Finally, many of the individuals who hold current positions on the Industrial Advisory Board are graduates of the program, and their observations reflect their own experience as well as those of a network of classmates.

3.2. Assessment of Program Outcomes

The Computer Science Department's program assessment cycle/process for CINS, shown in Figure 1, below, is based on Dr. Gloria Roger's Model for Quality Assurance of Student Learning Outcomes:
Multiple sources of data for individual PEOs or POs are combined using weighted average to take into account the number or respondents contributing to each data source.

To transform percentage ratings (between 0 through 100 inclusive) to a 5-point (5: highest, 1: lowest) Likert scale score, the data undergo a simple linear rescaling.

The department has chosen a “threshold” score of 70% (percentage scale), for satisfactory performance, which converts to a score of 3.5 on a five point Likert scale. Scores of 3.5 or above are the target for all PEO and PO assessments.

3.2.1. Embedded Assessment

Table 2, below, details the current alignment between the program core courses and the program student learning outcomes. The specific courses in which embedded measures were used to assess specific outcomes are shown in Table 2. The entries in the table are ‘I’ for Introduced, ‘P’ for Practiced and ‘A’ for Assessed. Those courses whose rows have ‘A’ s are the courses used in 2014-15 for embedded assessment.

The 2014-15 embedded assessment data for CINS reflected the modified schedule of collection, as the staggered, 3-year collection schedule was replaced with an annual cycle in 2010 that allowed all POEs to be assessed on an annual basis. The annual assessment cycle that was established allowed the department to keep much closer tabs on all Program Outcomes. The collection schedule is presented in Table 3.
## Table 2: Core CINS Course x CINS Program Outcomes Matrix.

<table>
<thead>
<tr>
<th>CINS Courses (minus electives)</th>
<th>Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>ECON 103 Princ. Of Micro Econ</td>
<td>I</td>
</tr>
<tr>
<td>MATH 105 Statistics</td>
<td>I</td>
</tr>
<tr>
<td>MATH 109 Survey of Calculus</td>
<td>I</td>
</tr>
<tr>
<td>CSCI 111 Programming and Algorithms I</td>
<td>P</td>
</tr>
<tr>
<td>ACCT 201 Intro to Financial Acct.</td>
<td>I</td>
</tr>
<tr>
<td>ACCT 202 Intro to Managerial Acct.</td>
<td>I</td>
</tr>
<tr>
<td>CSCI 211 Programming and Algorithms II</td>
<td>P</td>
</tr>
<tr>
<td>CSCI 217 or MATH 217 Discrete Math</td>
<td>P</td>
</tr>
<tr>
<td>CINS 220 PCs &amp; Peripherals</td>
<td>P</td>
</tr>
<tr>
<td>CINS 242 Information Systems Design</td>
<td>P</td>
</tr>
<tr>
<td>CSCI 301 Computers &amp; Society</td>
<td></td>
</tr>
<tr>
<td>MINS 301 Computer Techn. Integ.</td>
<td></td>
</tr>
<tr>
<td>BLAW 302 Managing the Legal Envir.</td>
<td>P</td>
</tr>
<tr>
<td>MGMT 303 Survey of Management</td>
<td>P</td>
</tr>
<tr>
<td>MKTG 305 Survey of Marketing</td>
<td></td>
</tr>
<tr>
<td>FINA 307 Survey of Finance</td>
<td>P</td>
</tr>
<tr>
<td>CSCI 311 Algorithms and Data Structures</td>
<td>A</td>
</tr>
<tr>
<td>CSCI 340 Operating Systems</td>
<td>P</td>
</tr>
<tr>
<td>CSCI 446 Intro to Networks</td>
<td></td>
</tr>
<tr>
<td>CINS 370 Introduction to Databases</td>
<td>A</td>
</tr>
<tr>
<td>CINS 448 Computer Security</td>
<td>P</td>
</tr>
<tr>
<td>CSCI 465 Web Programming Fundam.</td>
<td>P</td>
</tr>
<tr>
<td>CINS 490 Directed Program. Experience</td>
<td>P</td>
</tr>
</tbody>
</table>
I = Introduced, P = Practiced, A = Assessed
Table 3: Embedded Assessment Cycle for CINS Classes in 2014-15

<table>
<thead>
<tr>
<th>Course</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 301</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSCI 311</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>spring</td>
</tr>
<tr>
<td>CSCI 370</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>spring</td>
</tr>
<tr>
<td>CSCI 446</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fall</td>
</tr>
<tr>
<td>CINS 448</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fall</td>
</tr>
<tr>
<td>CINS 465</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fall</td>
</tr>
<tr>
<td>CSCI 490</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fall/spr.</td>
</tr>
</tbody>
</table>

Table 4 below, summarizes the assessment data available since 2009. Annual data collection began in 2009-2010, when embedded data for all outcomes was first collected. Each score represents the composite of the embedded scores collected in the selected courses (see Table 3, above) and scaled to fit the standard five-point (5: high, 1: low) Likert scale adopted by the department. The Department collects assessment workbooks from all faculty participating in assessment each semester and combines these into a ‘Master Worksheet’ that
display all of the data collected and averages the outcome scores when more than one course was used for assessment. An example of a ‘Master Worksheet’ is shown in Appendix C.

**Table 4:** Trends in Embedded Assessment Data for B.S. in CINS program.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>3.889</td>
<td>2.89</td>
<td>3.759</td>
<td>3.674</td>
<td>3.5</td>
<td>3.86</td>
</tr>
<tr>
<td>b</td>
<td>4.472</td>
<td>5</td>
<td>4.75</td>
<td>4.319</td>
<td>4.7</td>
<td>4.5</td>
</tr>
<tr>
<td>c</td>
<td>3.741</td>
<td>3.79</td>
<td>3.743</td>
<td>4.213</td>
<td>4</td>
<td>4.23</td>
</tr>
<tr>
<td>d</td>
<td>3.75</td>
<td>4.71</td>
<td>3.947</td>
<td>4.25</td>
<td>3.7</td>
<td>4.17</td>
</tr>
<tr>
<td>e</td>
<td>5</td>
<td>4.5</td>
<td>3.53</td>
<td>4</td>
<td>4.6</td>
<td>3.68</td>
</tr>
<tr>
<td>f</td>
<td>4.792</td>
<td>4</td>
<td>4.618</td>
<td>4.198</td>
<td>4.6</td>
<td>3.6</td>
</tr>
<tr>
<td>g</td>
<td>5</td>
<td>3.75</td>
<td>3.53</td>
<td>3.5</td>
<td>4.6</td>
<td>3.68</td>
</tr>
<tr>
<td>h</td>
<td>5</td>
<td>3.64</td>
<td>3.75</td>
<td>3.5</td>
<td>3.6</td>
<td>3.68</td>
</tr>
<tr>
<td>i</td>
<td>5</td>
<td>3.33</td>
<td>3.798</td>
<td><strong>2.5</strong></td>
<td>3.5</td>
<td>4.15</td>
</tr>
<tr>
<td>j</td>
<td>5</td>
<td>3.88</td>
<td>4.337</td>
<td>3.864</td>
<td>4.5</td>
<td>4.32</td>
</tr>
</tbody>
</table>

(Note: red text in a cell marks scores falling below department criterion of 3.5)
The data in Table 4 is displayed above in Figure 2 to more effectively show trends.

### 3.2.2. Discussion of Embedded Assessment Results

Figure 2 and the table it is based upon provide data that offer some insight as to the trends currently occurring within the CINS program. The discussion is organized by Program Outcome and shown, in sequence, in Table 8.
Table 5: Analysis of CINS Program Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Score 2013-14</th>
<th>Score 2014-15</th>
<th>Analysis of Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) An ability to apply knowledge of computing and mathematics appropriate to the discipline.</td>
<td>3.5</td>
<td>3.86</td>
<td>This is showing an increase from historical data. Not a cause for concern.</td>
</tr>
<tr>
<td>b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.</td>
<td>4.7</td>
<td>4.5</td>
<td>This value was high last year and has dipped only slightly and shows no cause for concern.</td>
</tr>
<tr>
<td>c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.</td>
<td>4</td>
<td>4.23</td>
<td>This outcome improved slightly and is no cause for concern.</td>
</tr>
<tr>
<td>d) An ability to function effectively on teams to accomplish a common goal.</td>
<td>3.7</td>
<td>4.17</td>
<td>This score has improved and is still no cause for concern here.</td>
</tr>
<tr>
<td>e) An understanding of professional, ethical, legal, security, and social issues and responsibilities.</td>
<td>4.6</td>
<td>3.68</td>
<td>This score has dipped nearly a point and although still in the acceptable range, should be monitored carefully.</td>
</tr>
<tr>
<td>f) An ability to communicate effectively with a range of audiences.</td>
<td>4.6</td>
<td>3.6</td>
<td>This score has dipped nearly a point and although still in the acceptable range, should be monitored carefully.</td>
</tr>
<tr>
<td>g) An ability to analyze the local and global impact of computing on individuals, organizations and society.</td>
<td>4.6</td>
<td>3.68</td>
<td>This score has dipped nearly a point and although still in the acceptable range, should be monitored carefully.</td>
</tr>
<tr>
<td>h) Recognition of the need for, and an ability to engage in, continuing professional development.</td>
<td>3.6</td>
<td>3.68</td>
<td>This outcome shows a very slight improvement and is still above the minimum criterion of 3.5.</td>
</tr>
<tr>
<td>i) An ability to use current techniques, skills, and tools necessary for computing practice.</td>
<td>3.5</td>
<td>4.15</td>
<td>This score showed a nice increase and is now well above the minimum criterion of 3.5.</td>
</tr>
<tr>
<td>j) An understanding of and an ability to support the use, delivery, and management of information systems within an Information Systems environment. [IS]</td>
<td>4.5</td>
<td>4.32</td>
<td>This score has dropped only slightly and is well above the minimum criterion of 3.5, no concerns here.</td>
</tr>
</tbody>
</table>

3.2.3. Faculty Reflections on Embedded Assessment Data

When faculty members fill out their embedded assessment report forms (Excel spreadsheets), they are asked to reflect upon the assessment results. When the measurement score for an outcome in one of their courses comes in below 70% (or 3.5 on a Likert scale) the faculty member comes up with a plan for improving the outcome in the subsequent semester. For each of the outcomes, a) through k), below are the faculty comments on their metric and results, the effectiveness of the assessment instrument and their planned actions to improve attainment of the outcome, if necessary. Improvement plans are in bold and italic for emphasis.
Faculty Commentary on Assessment Results and Continuous Improvement Responses:

For each of the outcomes, a) through j), below are the faculty comments on their metric and results, the effectiveness of the assessment instrument and their planned actions to improve attainment of the outcome, if necessary:

**Outcome a):** Dr. Challinger used the comprehensive final exam as a metric for this outcome in the core class CSCI 311. Students must earn 70% or better on the comprehensive final exam to achieve this outcome. There were only 7 CINS majors that enrolled and completed the course (the students who had an unauthorized withdrawal have been eliminated from consideration). The percentage of students passing this metric decreased significantly from 75% to 43% this semester. However, the sample is very small and thus it is difficult to come to solid conclusions. One of these students had their CSCI 211 course from a very poor instructor (newly hired lecturer) who was fired after the fall 2014 semester and clearly did not learn the skills they needed to learn. The data is skewed in this regard.

**Outcome b) and c):** Professor Zeichick used in class labs in CINS 448 to test the student's ability to solve a challenge using computer security tools (Kali Linux tool suite). 11 out of 13 CINS majors were able to complete the labs successfully. The measure is very effective. The use of this suite of security tools has improved the achievement of these outcomes.

**Outcome d):** Professor Im used a total of 28 small lab assignments many of which require group work to assess this outcomes. The assignments heavily depend upon other members to work in collaboration to achieve their goal. The metric used is the grades for the labs. The students must achieve an average of 75% or higher to pass this metric. The number of students who passed this metric (12 out of 15) closely matches the number who received a C- or better in the course. These results indicate the measure turns out to be very accurate.

Professor Raigoza sought to have students achieve outcome d) by expecting group members to lead or participate in a demanding project with regular assessments. The project simulated a real-life industry assignment including professionalism and an opportunity for creativity. Some project groups tended not to evenly distribute the work load. Hence, submitted work required a description of each member's contribution and also, regular meetings with the project group and the instructor were conducted. Additional meetings with the instructor were conducted with groups who needed more guidance. 24 out of 28 or 86% of the Computer Information Systems majors succeeded in their group work. The metric was effective. The groups accomplished their work and enjoyed their contribution.

**Outcome e) and f):** Professor Hubbard used selected well-written essays which demonstrate understanding of professional, ethical, legal, security and social issues and
responsibilities for Outcome e). For outcome f) students made presentations of their work and participated in lively in-class debates and discussion. The measures are very effective. The number of student’s passing this metric went down from 92% on average last year to 73.6% this year. Although still in the acceptable range, these outcomes will be more closely monitored next year.

Outcome g): In his CSCI 490, senior project class, Dr. Henry uses the following metric: Students must complete the senior project and give the presentation during their scheduled time and receive adequate or better on the audience review forms. Students and faculty attend the presentation. The ability to present a semester long project is a good indication of a student’s ability to communicate technical information. Four out of six or 66.67% were successful. The number of students assessed however, is quite small to be statistically significant. The measure is effective and does not need to be modified. Some students are extremely burned out in the last semester of their senior year and have difficulty focusing. Dr. Henry will give more pep talks on the value of completing the degree successfully.

Outcome h): Professor Hubbard used selected well-written essays which demonstrate understanding of professional, ethical, legal, security and social issues and responsibilities for Outcome h). Students student a number of essays and writings that emphasize the rapidly changing nature of the field and the need to stay engaged and continually learning to keep up. The number of student's passing this metric went down from 92% on average last year to 73.6% this year. Although still in the acceptable range, these outcomes will be more closely monitored next year.

Outcome i): Dr. Henry had the following commentary on CINS 465 - Web programming is a very broad field. There are thousands of libraries, frameworks, and packages that aid in web application development. There is not enough time to discuss everything. Students are expected to learn libraries, frameworks, and packages on their own. The metric here demands that students use components that were not discussed in class. This semester I encouraged students more to learn and use new components. 84% of the CINS students met this challenge. Next semester I will require the use of libraries, tools, packages, etc. as part of the final project. The measure is very effective and no changes are needed at this time.

Dr. Henry also noted that while the number of CINS students who passed the metric of completing a significant senior project was only 66.67%, this percentage is based on a very small data set, 4 out of 6 total CINS majors. Thus, the data set is too small to be statistically significant and the overall average of the scores of 3 courses that measured outcome i), which is 83% or 51 out of 59 total students is a far more accurate measure.

Outcome j): Dr. Henry had the following commentary on CINS 465 – The student’s final semester project must be running on a remote Linux server to get credit for the assignment. This was such a strict requirement, that all students who did not give up on the course completed. Students had to administer their Linux server themselves, thus
hosting applications is a clear assessment of their ability to deliver a web-based
application. 23 out of 25 succeeded, which is a pleasing result. **While the metric does not need to change, as part of the Annual Program Improvement Plan, Dr. Henry plans to provide a much more comprehensive, detailed description of requirements for the final project, explicitly defining what is required to do well on the project.**

As is generally the case, the faculty concerns expressed dealt more with the detailed mechanics by which the various student learning outcomes are achieved within the course and how the outcomes might be improved. It would be very helpful if the results of the “Major Field Test” included subtest scores that could be mapped to individual outcomes. This would provide an anchor point to validate the balance of results that apply to outcomes.

It is also anticipated that decreasing our class sizes, a plan we are implementing beginning fall 2015 will assist in better Student Learning Outcomes overall. Decreasing class sizes has been made possible largely to the additional hires the department has received and will continue to receive. These additional hires stem from the administration’s recognition that our program is growing significantly, both in the undergraduate and MS programs. It is also acknowledged that the growth of enrollment in the Mechatronics Engineering and Computer Engineering programs also increases demands on the Computer Science department, since their majors take our programming courses. The department has hired five new tenure-track faculty in the past four years and has been approved for at least one more tenure-track hire during 2015-16.

The department has made some curriculum changes in its undergraduate degrees and these changes are anticipated to improve the Student Learning Outcomes. We have added elective courses in Bioinformatics, Advanced Algorithm Analysis and two courses in software engineering: Usability and Software Testing. These courses were created on the initiative of the new junior faculty, taking into account their in-depth expertise. The advanced algorithms course is anticipated to improve scores on outcomes a, b, c, i, j and k. The Department has also added a required lower-level web programming course, CINS 110, as a prerequisite to CINS 465, effective with the 2015-16 catalog. The instructor for CINS 465 has observed that the backgrounds of the current students in CINS 465 are extremely disparate, making it difficult to effectively teach the course. Our Industry Advisory Board has also emphasized the critical importance of a solid skill set in web programming during the Interactive Workshop held in fall 2014. The results of this Workshop are in Appendix A. Since we have modified the CINS curriculum, adding a prerequisite course, CINS 110, Programming in JavaScript, students should be much more uniformly prepared for CINS 465.

### 3.3. Indirect Assessment of the Program Outcomes
#### 3.3.1. Senior Exit Survey
The senior exit survey conducted by the college gives an indirect measure of how well graduating students feel they have met the program outcomes. Data from 2012-2013 that were specific to CINS graduates focused on questions 31 to 44:
“As a graduate, do you believe that you now know how to:”
31. Apply knowledge to solve problems
32. Design and conduct experiments
33. Analyze and interpret experimental data
34. Design component or system to meet needs
35. Function on multidisciplinary team
36. Identify, formulate, solve technical problems
37. Communicate technical matters in writing
38. Communicate technical matters orally
39. Understand professional, ethical responsibilities
40. Understand contemporary issues facing society
41. Use modern tools and technology
42. Appreciate impact of your solutions on society and environment
43. Have an appreciation for the importance of continued learning.

Eight (8) CINS students took the questionnaire in 2014-15. The results are summarized in Table 6, below over the past five years. For the senior surveys, responses are identified as follows: strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1.
**Table 6 - Indirect Assessment Data from CINS Senior Exit Surveys**

<table>
<thead>
<tr>
<th>Student Learning Outcome</th>
<th>Measure</th>
<th>Sp '15 Average (Sample size)</th>
<th>Sp '14 Average (Sample size)</th>
<th>Sp '13 Average (Sample size)</th>
<th>Sp '12 Average (Sample size)</th>
<th>Sp '11 Average (Sample size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td></td>
<td>8</td>
<td>14</td>
<td>11</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>(a) An ability to apply knowledge of computing and mathematics appropriate to the program’s student outcomes and to the discipline</td>
<td>Question 31</td>
<td>3.88</td>
<td>4.07</td>
<td>3.73</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution</td>
<td>Question 33 (analyze data)</td>
<td>4.25</td>
<td>4.29</td>
<td>3.73</td>
<td>3.8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Question 36 (solve problems)</td>
<td>3.75</td>
<td>4.21</td>
<td>3.82</td>
<td>4.2</td>
<td>4</td>
</tr>
<tr>
<td>(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs</td>
<td>Question 34</td>
<td>4.13</td>
<td>4.64</td>
<td>3.64</td>
<td>4.2</td>
<td>3.7</td>
</tr>
<tr>
<td>(d) An ability to function effectively on</td>
<td>Question 35</td>
<td>3.88</td>
<td>4.21</td>
<td>3.64</td>
<td>4.5</td>
<td>4.2</td>
</tr>
<tr>
<td>teams to accomplish a common goal</td>
<td>Question 39</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(e) An understanding of professional, ethical, legal, security and social issues and responsibilities</td>
<td>4.38</td>
<td>4.57</td>
<td>3.64</td>
<td>4.2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Question 37 (written comm.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 38 (oral comm.)</td>
<td>4.38</td>
<td>4.36</td>
<td>3.73</td>
<td>4.2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Question 42</td>
<td>4.13</td>
<td>3.93</td>
<td>3.82</td>
<td>4</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>(f) An ability to communicate effectively with a range of audiences</td>
<td>4.38</td>
<td>3.93</td>
<td>3.64</td>
<td>4.3</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society</td>
<td>4.00</td>
<td>4.00</td>
<td>3.91</td>
<td>4.3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Question 43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(h) Recognition of the need for and an ability to engage in continuing professional development</td>
<td>4.5</td>
<td>4.86</td>
<td>3.82</td>
<td>4.4</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Question 41</td>
<td></td>
<td></td>
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</tbody>
</table>
Expected Level of Attainment and Analysis
The faculty decided that a reasonable level of attainment is 3.5 on a Likert scale of 0 to 5 for each outcome. Note: some outcomes are assessed by two different questions. Table 6, above, shows the results over the past 5 years, beginning in Spring 20011, on a Likert scale for each question and the related Student Learning Outcome(s). Using the Likert scale, a score of 5 represents 100%, while a score of 3.5 represents 70%. The Computer Science Department is concerned about any scores that dip below 3.5 on a Likert scale as this shows an improvement plan is needed to improve the related student outcomes. The Likert scale over the past 5 years, although it shows some slight downward trends, has no scores in any outcome below a 3.5 in the past 4 years, and only 1 score overall below a 3.5 in the past 5 years. This indirect assessment method is currently not showing cause for concern.

1) Indirect Assessment using the Institute for Certification of Computing Professionals (ICCP) Exam for Computer Information Systems Seniors

The ICCP Exam taken by seniors graduating from the Computer Information Systems program measures knowledge and application of computing and information systems practices and principles and measures all of the ABET CAC outcomes for Information Systems programs, with the exception of Outcome h). Every senior taking CINS 490, the Senior Project Course, must take the ICCP during the semester that they are in the class, whether they take it in fall or spring. The scores are averaged over the academic year. Below is a table and graph of the average scores for the last 4 years. The results for 2015 will not be made available until the end of June 2015. The exams have 251 questions over 9 sections, sections a-g and i-j, each section corresponding to an ABET outcome. Sections i) and j) are by far the most extensive, with 109 and 51 questions respectively. It should be noted that the ICCP exam scores are percentile rank scores in a test used to place IS professionals, both new grads and experienced professionals with many years of experience, into IS positions at all levels. A score of 40% is quite good for a graduating senior.
Table 7 - Four Years of Results on the Institute for Certification of Computing Professionals Exam for Computer Information Systems Seniors

<table>
<thead>
<tr>
<th>Student Learning Outcome</th>
<th>Measure</th>
<th>Sp ’15</th>
<th>Sp ’14</th>
<th>Sp ’13</th>
<th>Sp ’12</th>
<th>Sp ’11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>($) (Sample size)</td>
<td>15</td>
<td>11</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>(a) An ability to apply knowledge of computing and mathematics appropriate to the program’s student outcomes and to the discipline</td>
<td>23 exam questions</td>
<td>results for Sp'15 not until 6/25/2015</td>
<td>50.4</td>
<td>51.4</td>
<td>61.7</td>
<td>69.6</td>
</tr>
<tr>
<td>National Avg a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43.7</td>
</tr>
<tr>
<td>(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution</td>
<td>13 exam questions</td>
<td>61.5</td>
<td>62.2</td>
<td>61.5</td>
<td>65.4</td>
<td></td>
</tr>
<tr>
<td>National Avg b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>53.2</td>
</tr>
<tr>
<td>(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs</td>
<td>17 exam questions</td>
<td>60.0</td>
<td>63.1</td>
<td>60.0</td>
<td>69.1</td>
<td></td>
</tr>
<tr>
<td>National Avg c)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>54.3</td>
</tr>
<tr>
<td>(d) An ability to function effectively on teams to accomplish a common goal</td>
<td>12 exam questions</td>
<td>66.7</td>
<td>63.6</td>
<td>65.0</td>
<td>81.3</td>
<td></td>
</tr>
<tr>
<td>National Avg d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58.8</td>
</tr>
<tr>
<td>(e) An understanding of professional, ethical, legal, security and social issues and responsibilities</td>
<td>17 exam questions</td>
<td>55.3</td>
<td>66.8</td>
<td>58.8</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td>National Avg e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>52.3</td>
</tr>
<tr>
<td>(f) An ability to communicate effectively with a range of audiences</td>
<td>5 exam questions</td>
<td>74.0</td>
<td>78.2</td>
<td>88.0</td>
<td>95.0</td>
<td></td>
</tr>
<tr>
<td>National Avg f)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>76.0</td>
</tr>
<tr>
<td>(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society</td>
<td>4 exam questions</td>
<td>47.5</td>
<td>50.0</td>
<td>50.0</td>
<td>56.3</td>
<td></td>
</tr>
<tr>
<td>National Avg g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47.2</td>
</tr>
<tr>
<td>(i) An ability to use current techniques, skills, and tools necessary for computing practice.</td>
<td>109 exam questions</td>
<td>48.3</td>
<td>58.1</td>
<td>63.5</td>
<td>65.8</td>
<td></td>
</tr>
<tr>
<td>National Avg i)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47.2</td>
</tr>
</tbody>
</table>
(j) An understanding of and an ability to support the use, delivery, and management of information systems within an Information Systems environment. [IS]

<table>
<thead>
<tr>
<th>51 exam questions</th>
<th>51.2</th>
<th>54.7</th>
<th>60.0</th>
<th>64.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Avg</td>
<td>52.0</td>
<td>51.8</td>
<td>51.8</td>
<td>52.0</td>
</tr>
</tbody>
</table>

Figure 3: Trends over the Past Four Years in Outcome Scores on the ICCP Exam

Comparing the scores on the ICCP over each of the nine outcomes assessed, Chico State Computer Information Seniors did better in 2014 than all other computing professionals taking the test, except for one category, outcome f, which measures effective communication. In outcome f) the national average score was 76% while Chico CINS seniors scored 74%, just slightly below the average. Looking over the data in Table 7, Chico CINS seniors have by and large done better than the national average in nearly
every outcome for every year they have taken the test. The fact that no score is at or below 40% over these past four years is testament to the fact that Chico CINS majors have learned the skills to demonstrate their capabilities nicely in outcomes a-g and i-j. A portion of the yearly results report that ICCP sends to the Department is included in Appendix J. This example report shows how the scores for each outcome are calculated and just what questions on the test measure what outcomes. The test results also give Chico’s individual question and outcome scores next to the respective National Average score for each outcome.

2) **Indirect Assessment via Feedback from the Industry Advisory Board and other Employers**

The Computer Science Department regularly meets twice a year with our Industry Advisory Board and has planned workshops as part of these meetings to solicit feedback on the objectives and outcomes for Computer Information Systems graduates. The most recent workshop in fall 2014 provided numerous suggestions for enhancing the skills sets of our students and these suggestions align nicely with planned curriculum changes, discussed below.

**Summary of Outcome Assessment**

- **Outcome a):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcome b):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcome c):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcome d):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcomes e), f, and g):** Direct assessment data for outcomes e), f) and g) are still in the acceptable range of above 70%, yet the data show a significant drop of 18-20 percentage points over the previous years embedded measures. The indirect attitudinal ‘senior survey’ actually shows an improvement in what students perceive in how well they have attained these outcomes. The more objective ICCP exam does show drops over last year in these 3 outcomes, yet they are small drops, and not nearly as significant as our own embedded data imply. Regardless, these 3 outcomes and the courses that measure them will receive more focused attention in next year’s assessment plan.
- **Outcome h):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcome i):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
- **Outcome J):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
Assessment data, both from embedded assessment and indirect assessment has contributed to some changes in curriculum that took place last year. We as a department made some changes to our course offerings to improve the instruction in the courses and better achieve the student learning outcomes. The unit number was reduced from 128 to 120 units to be consistent with recommendations from the CSU Chancellor’s office to reduce the number of units in all university majors at CSU campuses. To accomplish this we were able to get one of the required upper-division core courses (CSCI 301) to ‘double-count’ as being part of any General Education Pathway, reducing the number of Pathway GE courses from 3 to 2. We were also able to get CSCI 217 recognized as an Area A3, Critical Thinking, course. This reduced the unit count for the major from 128 to 122. To accomplish the other 2 units of reduction, 2 units of elective were removed.

As our number of tenure-track faculty has been steadily growing, we have been able to offer more courses during both the fall and spring semesters, which makes schedule planning and advising for our students much easier. We are also accomplishing a reduction in class size in spite of the growth in our number of majors and majors in other programs (e.g. Mechatronics and Computer Engineering) that create enrollment growth in our programming series, CSCI 111, 211 and 311.

The Department conducted a special interactive workshop together with our entire Industry Advisory Board (currently with over 30 members) in fall 2014. The purpose of the workshop was to identify the key skills and courses that are desirable for our graduates. The workshop emphasized the need for a solid background in web development, including exposure to various tools and languages, including JavaScript. The workshop also emphasized further understanding of analysis of algorithms and applications to problem solving. Other skills and tools emphasized were a solid background in Software Engineering, including usability and testing. Computer security skills were also emphasized.

Based on the workshop feedback and the skill sets brought to the Department by our new faculty hires we have made adjustments to the curriculum in the past 2014-15 academic year. The new faculty bring with them new areas of expertise/concentration and we have gained faculty well-versed in bioinformatics, networks, operating systems, security and software engineering.

Realizing the importance of a solid background in web-programming, we added, to take effect in fall 2015, a required introductory web-programming course to our CSCI degree, CINS 110 that features use of JavaScript. This course will ensure that the students taking CINS 465 all have at least a minimum of background coming into that upper division course and more can be accomplished. CINS 465 is currently taught using Ruby on Rails, so web
programmers will be introduced to different languages and environments in web programming, one of the key pieces of feedback from our Industry workshop. We were able to add this course without increasing the degree unit count by removing CSCI 340, Operating Systems Programming, from the list of required courses. The faculty felt that this course was not of as great a significance to CINS majors as it is to CSCI majors.

Our new Software Engineering faculty expert has many new courses that he would like to add to the curriculum and this past spring 2015 semester he offered a course on ‘Usability’ which was quite popular. He has also developed an upper division course on Software Testing. Both of these skills were emphasized in the feedback from our Industry workshop.

One of our new Bioinformatics faculty was able to offer an introductory upper division course in spring 2015 and she has developed a new course in Advanced Algorithm Analysis and Problem Solving which we will be piloting next semester, fall 2015. This new Algorithms course shows promise in increasing our students’ performance in outcomes a through c as well as i and j. Further understanding of algorithms and complexity and their application to efficiently solve problems was emphasized during our Industry workshop.

To conclude, we have responded rapidly to the feedback from our constituents by improving our curriculum and offering new courses that directly address the outcomes we are striving toward. Our assessment measures detailed in the previous section of this report clearly document significant improvement in the performance on key outcomes.

3.3.2. Industry Advisory Board Workshop Feedback

The Computer Science Department regularly meets twice a year with our Industry Advisory Board and has planned workshops as part of these meetings to solicit feedback on the objectives and outcomes for Computer Information Systems graduates. The most recent workshop in fall 2014 provided numerous suggestions for enhancing the skills sets of our students and these suggestions align nicely with planned curriculum changes, discussed below. The results of this Interactive Workshop can be found in Appendix A.
4. Continuous Assessment: Conclusions and Concerns

As noted above, some changes in the curriculum are anticipated to improve the outcome scores for outcomes that came in below standard in the 2014-15 assessment cycle. The introduction of a new, prerequisite course for CINS 465 should assist in improving outcomes in that course. The instructor is also planning on focusing much more attention during the course on design principles. The new Advanced Analysis of Algorithms course should also assist students improving outcomes a, b, c, i, j and k. The CSCI 340 class is getting an overhaul by Dr. Dixon and he anticipates that his changes, focusing on more in-class examples of topics covered, will serve to improve the outcomes in that course.

4.1. Program Educational Objectives

During the fall 2014 Industry Advisory Board, two Interactive Workshops were conducted. One addressed the skills that the Board feel are needed by current graduates, the other focused on reviewing and making suggestions to the program educational objectives. The results of the workshop that focused on objectives are given in Appendix B.

4.2. Program Outcomes

The embedded assessment data suggest that there are some potential problems in two outcomes. The curriculum changes and instructor’s improvement plans should serve to address these problems, and the outcomes will be monitored carefully next year. The Senior Exit Survey indicates that students perceive they are obtaining valuable skills from the CSCI program. A third source of data, the MFT, has remained fairly steady-state and indicates satisfactory achievement of outcomes.

4.2.1. Embedded Assessment

Outcomes i and j were the only two outcomes that showed some concern. Outcome i measurements were taken in three courses over 2014-15. Only one of these courses, CSCI 340, had a measurement below the standard and that measurement came in at 68% (3.4 on Likert scale), which is only marginally below the standard. It should be noted, however, that average of the three courses scores used to measure outcome i came in at 80% (4.0 on Likert scale), which is well above the standard. Dr. Dixon has a plan for improving this outcome in CSCI 340 and his assessment scores will be monitored closely next year to ascertain whether or not improvement has occurred.

The only outcome that shows an overall cause for concern is outcome j) since the average score of the two courses that measured outcome j came in at 65% (3.25 on Likert scale). However, CSCI 340’s measure for outcome j) came in at 81% (4.05 on Likert scale) which is well above the standard. Improvement in this outcome should come about in subsequent
years due the new requirement, beginning with the 2015-16 catalog, that students must take a prerequisite course prior to taking CINS 465. Additionally, Dr. Henry plans on providing much more instruction on good design principles in the fall 2015 offering of CINS 465. This outcome will be monitored closely in anticipation of improvement next year.

4.2.2. Senior Survey

Not a single score showed a cause for concern, although scores did dip in general somewhat from the previous year. These attitudinal scores will be monitored carefully from year to year. It is anticipated that the growth of the faculty size and the infusion of enthusiastic junior faculty in the ranks as well as the planned decreases in class sizes, will serve to enhance students attitudes and the results on the senior survey.

4.2.3. The ICCP Exam

The scores on the ICCP have shown Chico CINS graduating seniors score consistently well on the exam and have remained at or above national averages in all measured ABET outcomes.
5. Appendix A: Continuous Improvement Method: Fall 2014 Interactive Workshop with Computer Science Industry Advisory Board – Results

Feedback from fall 2014 Industry Advisory Board workshop on needed skills of our Graduates:

Background: The Computer Science Department held its regular bi-semester meeting in the fall of 2014 in on the Chico campus. This meeting was well-attended with over 20 members present. Computer Science tenure-track faculty member Todd Gibson conducted an interactive workshop in which groups 5 groups of 4 or 5 members walked around the room with their groups and gave their thoughts on the five key questions below. The workshop was quite dynamic, all members truly enjoyed it and many stated: “This is why we wanted to be on your board, to be able to give you this feedback.”

What skills have recent graduates acquired that are of little use? Or, what misconceptions do recent graduates have when they walk into their first job?

Misconceptions:
+ Expectation to make "big impact" day 1. (you need to be prepared to learn, and work your way up)
+ Some work will always be mundane -- deal with it!
+ You might have to work with other people’s code.
+ Process/paperwork exists and may slow you down.
+ Lack of understanding of the big picture and the life cycle (operations) of a system as application
+ Acquired & of little use: traditional Software Development Approaches
+ Misconception that their learning has just ended...it has just started -- they need to understand there is a lot to learn
+ Misconception that employers don't care how often grads change jobs.
+ The "halo effect" matters

What skills do you expect a Master's graduate to have that an undergraduate typically doesn't have?

+ Be able to work independently and start contributing without much new training
+ Have real world experience, e.g., summer internship
+ Self-starter - Understand root cause (analysis) and carry projects through completion (end-to-end).
+ out-of-the-box creativity, i.e., transformation vs incremental
+ Software development best practices and design patterns/architectural approaches.
+ Specialization in a certain field
+ Collaboration skills
+ Advanced understanding in architecture
+ Algorithms/analysis
+ There is Science in C.S. - not just programming

What skills (independent of tool/environment) do you want your recently graduated hires to have that they currently lack?

+ Needs, Approach, Benefits, Competition (NABC) type skills
- 1 minute elevator pitch
- Presentation of ideas to influence decision makers
- Ability to "boil up" the details to a big picture view
+ Familiarity with popular toolsets/environments (get, AWS, Google analytics)
+ Ability to assess "build vs buy"
+ Flexibility/adaptability. This requires fundamental problem solving skills and solid CSCI fundamentals
+ SQA or more generally, Quality
+ Development life cycle: requirements, design, build, test, ...
+ Team software development - source control
+ learn how to fail fast
+ SCRUM, Agile methodology
+ Crisp & clear communications
  - Write a one-pager
  - deliver an elevator pitch
+ Think outside the box.
+ Hacker mentality
+ Change control, compliance
+ Project Management, interpersonal skills (esp. between [engineers?]!), understanding business needs), project scoping
+ Storyboarding - take ideas and build into (ideas?)

**Of the (tool/environment independent) skills that college graduates do have to varying degrees, which are most-important?**

+ Technical competence
+ Problem solving
+ work in a group - listen & communicate
+ Initiative
+ Must have base level of several important skills
  - Collaboration
  - Technical competence
  - Analytical thinking
  - Inquisitiveness
+ Problem solving
+ Debugging complex environments
+ versatility/adaptability
+ Willingness to understand big picture of company's objectives, not just write code
+ Technical depth
+ Be good students, i.e., understand & execute on what senior staff are telling them
+ client-side development
+ Grok (reverse engineer) other people's code.
+ do not over-iterate on code - knowing the balance of when code is good enough.
+ JavaScript, SQL, HTML/CSS - If they know this we can use them day 1

5) **If you could add any course(s) to the curriculum (may be tool/environment specific), what would you add?**

+ UX - User Experience ("Don't make me think")
+ Mobile Development (Responsive design, iOS, Android, HTML 5)
+ Interpersonal skills - How to remain human and interact with your organization
+ Project Management
+ Java
+ Analytics
+ Testing - Development lifecycle
+ Agile Methodologies
+ Cyber security/CS
+ Systems at scale
+ Parallel programming/distributed computing
+ Cloud computing - How to build an app in the cloud, e.g., AWS, Open Stack
+ Client-side development, e.g., JavaScript, not just C or C++ Programming
6. Appendix B: Results of Industry Advisory Board Interactive Workshop on Program Educational Objectives

The current statement for the CSCI Programs Educational Objectives immediately follows:

“The Department of Computer Science at CSU Chico is dedicated to graduating people who:
A. are able to apply the principles of computer science, mathematics, and scientific investigation to solve real world problems appropriate to the discipline;
B. are able to apply current industry accepted computing practices and new and emerging technologies to analyze, design, implement, and verify high quality computer-based solutions to real world problems;
C. exhibit teamwork and effective communication skills;
D. understand the ethical and technical context of their professional obligations and contributions;
E. are able to positively and appropriately apply knowledge of societal impacts of computing technologies in the course of career related activities; and
F. are successfully employed or accepted into a graduate program, and demonstrate a pursuit of lifelong learning.”

As an exercise in constituency feedback, we put the above statement of CSCI Program Educational Objectives up on the Web as a shared document and asked our Industry Advisory Board members to collectively contribute any edits to these that they thought would create a more effective and accurate statement. Below is the result of that exercise:

“The Department of Computer Science at CSU Chico is dedicated to graduating people who:
A. are able to apply analytical thinking together with the principles of computer science, mathematics, and scientific investigation to solve real world problems appropriate to the discipline;
B. develop and implement high-quality, innovative solutions to real world problems.
C. exhibit teamwork and effective communication skills;
D. understand the ethical and technical context of their professional obligations and contributions;
E. are able to positively and appropriately apply ethics in computing and ensure security and integrity of systems and data; and
F. are successfully employed or accepted into a graduate program, and demonstrate a pursuit of lifelong learning.”
Note: The language that was altered/removed in the original statement of objectives, at the top, is underlined and in yellow. The text phrases in the second version that are modifications of the original version are also underlined and in green.
7. Appendix C: Excel Spreadsheet of Combined Embedded Assessment 2014-15
<table>
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<tr>
<th>Course Code</th>
<th>Title</th>
<th>Mode</th>
<th>Total Credits</th>
<th>CTE</th>
<th>Student Success</th>
<th>Industry Success</th>
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<td>Computer Science I</td>
<td>L</td>
<td>3</td>
<td>30</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>C202</td>
<td>Computer Science II</td>
<td>L</td>
<td>3</td>
<td>30</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>C203</td>
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<td>L</td>
<td>3</td>
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<td>7</td>
</tr>
<tr>
<td>C204</td>
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<td>L</td>
<td>3</td>
<td>30</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: The above table is an example and the actual data may vary.